UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
		Docket No. 50-346-LR
First Energy Nuclear Operating Company	)	
(Davis-Besse Nuclear Power Station, Unit 1)		January 9, 2011
.	)	
	;	

* * * * *

INTERVENORS' MEMORANDUM IN OPPOSITION TO 'MOTION TO DISMISS' (OPPOSITION TO SUMMARY DISPOSITION OF CONTENTION 1)

Now come Beyond Nuclear, Citizens Environment Alliance of Southwestern Ontario (CEA), Don't Waste Michigan, and the Green Party of Ohio (collectively, Intervenors), by and through counsel, and set forth their opposition to FENOC's "Motion to Dismiss Contention 1."

I. THE 'MOTION TO DISMISS' IS A MOTION FOR SUMMARY DISPOSITION

Although captioned as a "Motion to Dismiss," the Applicant's motion is one seeking summary disposition of a pending contention on the ground of mootness, and so the requirements of 10 C.F.R. §2.710 pertain. Where, as here, an applicant claims to have remedied an alleged omission through responses to a Staff request for additional information (RAI), summary disposition of the contention on mootness grounds is the appropriate mechanism. *Exelon Generation Co.* (Early Site Permit for Clinton ESP Site), LBP-05-19, 62 NRC 134, 182 (2005). By calling its motion a "Motion to Dismiss" instead of a "Motion for Summary Disposition", FENOC perhaps hoped to ensnare Intervenors in an illusory filing deadline trap ((“motions” require a reply within 10 days, while “motions for summary disposition” afford a response period of 20

days).[1] But when it selected a stealth motion for summary disposition by titling it as one to dismiss, FENOC omitted to attach a "separate, short, and concise statement of the material facts as to which the moving party contends that there is no genuine issue to be heard." That is a requirement. See 10 C.F.R. §2.710(a). FENOC's omission to comply with the rules should doom this effort, since it has not followed the requisite procedure to establish the absence of material fact issues.

Intervenors (and apparently the NRC Staff) have treated the Motion to Dismiss for what it actually is - a motion for summary disposition - and Intervenors have attached a statement of material facts, see *infra.* The Board may properly ignore FENOC's *ipse dixit*, unilateral declarations of mootness, unsupported as they are by a meaningful factual exposition through affidavits or other evidence as required by 10 C.F.R. §2.710.

II. CONTENTION 1 IS NOT A CONTENTION OF OMISSION

FirstEnergy has tried to convert a fact-rich "analysis" contention, which requires a substantive showing of NEPA compliance, into an "omission" contention. FENOC cites this authority for its position (Motion to Dismiss at 6):

> '[A] significant change in the nature of the purported NEPA imperfection, from one focusing on a comprehensive information omission to one centered on a deficient analysis of subsequently supplied information,' *warrants issue modification by the complaining party.* Otherwise, absent any new pleading, the other parties would be left to speculate whether the concerns first expressed had been satisfied by the new information.

Citing *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), LBP-02-2, 55

[1] If so, then the Staff's January 9, 2012 "Response" is also untimely. The Staff calls FENOC's filing a "Motion to Dismiss Contention 1 as Moot," adding words to FENOC's chosen captioning. The Staff's one-line endorsement, given its imminent completion of the SDEIS, dispels any illusions of regulatory distance from FENOC.

NRC 20, 30. But *Private Fuel Storage* deals with an identified contention of omission, which that licensing board distinguished from "analysis" contentions based on the contention language itself:

> Consistent with the Board's other contention rulings, *see, e.g.,* LBP-01-26, 54 NRC 199, 207-08 (2001), *the 'has not considered' language of the contention as quoted above, as well as the original basis statement that also declared PFS 'has not considered the impact of flooding on the [ITF],' put this issue statement at the outset into the 'omission' rather than the 'analysis' category*, as we have previously defined them, *see* LBP-01-23, 54 NRC 163, 171 (2001).

(Emphasis supplied).

By contrast, in the instant matter, Contention 1 says:

> The FirstEnergy Nuclear Operating Company's Environmental Report fails to adequately evaluate the full potential for renewable energy sources, specifically wind power in the form of interconnected wind farms and/or solar photovoltaic power, in combination with compressed air energy storage, to offset the loss of energy production from Davis-Besse, and to make the requested license renewal action unnecessary. The FENOC Environmental Report (§ 7.2) treats all of the alternatives to license renewal except for natural gas and coal plants as unreasonable and does not provide a substantial analysis of the potential for significant alternatives in the Region of Interest.

This is not a contention of omission; it is an "analysis" contention. To attain summary disposition, FENOC must "***adequately*** evaluate the full potential for renewable energy sources . . . ." "Adequately" evokes the process of weighing evidence and the provision of bulk explanation and rationales, not mere discernment of whether an issue has finally been addressed in the Environmental Report. FENOC deployed this transformative paragraph in its campaign to metamorphose Contention 1 :

> The focus of Contention 1 is that the ER's consideration of renewable energy resources as alternatives to the relicensing of Davis-Besse is inadequate because 'it does not provide a substantial analysis' of interconnected wind farms combined with energy storage, solar photovoltaic energy combined with energy storage, and combinations of wind farms and solar photovoltaic energy with energy storage. *Now that FENOC has revised the ER to include the information that the Intervenors alleged to be missing, the*

Board should dismiss Contention 1 now [sic] as moot.

(Emphasis supplied) Motion at 5. In this passage, FENOC claims to have remedied "inadequate" consideration of renewable energy resources in the ER by "includ[ing] the information that the intervenors alleged to be missing." *Ipse dixit*, FENOC substituted its say-so of what Contention 1 says for what the contention, itself, expositively requires. Having settled the point Humpty-Dumpty style,[2] FENOC then presses the pretense that dismissal (summary disposition) of Contention 1 must follow, as the "omission" of substance has been requited. The problem is, of course, that the original Environmental Report discussed alternatives, but inadequately, as the Licensing Board found:

> Although many of the Joint Petitioners' exhibits do not specifically address FirstEnergy's region of interest, we find that they have provided the required 'alleged facts' and 'minimal' factual support for admitting a challenge which questions the sufficiency of the ER's examination of wind power, solar photovoltaic power, and a combination of both as alternatives to relicensing Davis-Besse.

FirstEnergy Nuclear Operating Company (Davis-Besse Nuclear Power Station, Unit 1) LBP-11-13 at 30 (slip op.). Moreover:

> [I] t appears to this Board that Joint Petitioners' contention posits that FirstEnergy should have identified a combination of wind and solar power as a reasonable alternative and analyzed it as such. Accordingly, we do not agree that Contention Three should be viewed as a contention of omission.

Id. at 32.

The Licensing Board's decision to admit the reworded Contention 1 is consistent with the

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[2] "When I use a word," Humpty Dumpty said, in a rather scornful tone, "it means just what I choose it to mean — neither more nor less."
"The question is," said Alice, "whether you can make words mean so many different things."
"The question is," said Humpty Dumpty, "which is to be master . . . that's all."
L. Carroll, Through the Looking-Glass (Raleigh, NC: Hayes Barton 6 Press, 1872), ISBN 1593772165, p. 72.

requirement that an applicant's alternatives analysis must be "sufficiently complete to aid the Commission in developing and exploring, pursuant to section 102(2)(E) of NEPA, 'appropriate alternatives'" to the proposed action. 10 C.F.R. § 51.45(b)(3) (referring to NEPA, 42 U.S.C. §4332(2)(E)). NEPA requires that an environmental review provide a sufficient discussion of alternatives to "'enable the decision-maker to take a "hard look" at environmental factors, and to make a reasoned decision.'" *Tongass Conservation Soc'y v. Cheney*, 924 F.2d 1137, 1140 (D.C. Cir. 1991) (quoting *Natural Res. Def. Council, Inc. v. Hodel*, 865 F.2d 288, 294 (D.C. Cir. 1988)).

This is not a circumstance where particular information has simply been left out of the ER, to be remedied by the applicant's emergent action, see *Amergen Energy Co., LLC* (Oyster Creek Nuclear Generating Station), LBP-06-16, 63 NRC 737, 742 (2006). Contention 1, as originally pleaded, then reformulated by the ASLB, is not an either-or proposition. Disposal of Contention 1 requires a substantive presentation by FENOC. FENOC's so-far dubious substance is counterbalanced by Intervenors in their accompanying "Statement of Facts Demonstrating Issues of Material Fact," discussed *infra*.

At this juncture, FENOC's only option to prevail on Contention 1 requires a trial. The burden of proof with respect to summary disposition rests upon FENOC, which must demonstrate the absence of any genuine issue of material fact. *Advanced Medical Systems, Inc.* (One Factory Row, Geneva, Ohio 44041), CLI-93-22, 38 NRC 102 (1993); *Dairyland Power Cooperative* (La Crosse Boiling Water Reactor), LBP-82-58, 16 NRC 512, 519 (1982), citing *Adickes v. Kress and Co.*, 398 U.S. 144, 157 (1970). Summary disposition is not appropriate when the movant fails to carry its burden of setting forth all material facts pertaining to its summary

disposition motion. *Gulf States Utilities Co.* (River Bend Station, Unit 1), LBP-95-10, 41 NRC 460, 466 (1995). When the matters presented fail to foreclose the possibility of a factual dispute, the moving party fails to meet its burden on summary disposition. *Entergy Nuclear Vermont Yankee, L.L.C., and Entergy Nuclear Operations, Inc.* (Vermont Yankee Nuclear Power Station), LBP-06-5, 63 NRC 116, 122 (2006). Intervenors, as nonmovant, are entitled to the favorable inferences that may be drawn from any evidence submitted. See *Sequoyah Fuels Corp*. (Gore, Oklahoma Site Decontamination and Decommissioning Funding), LBP-94-17, 39 NRC 359, 361, *aff'd*, CLI-94-11, 40 NRC 55 (1994); *Vermont Yankee*, LBP-06-5, 63 NRC at 121-22. An evidentiary hearing is necessary if a genuine issue of material fact is in dispute. *Advanced Medical Systems, Inc.* (One Factory Row, Geneva, Ohio 44041), CLI-93-22, 38 NRC 98, 119-20 (1993).

At a minimum, Contention 1 "involve[s] both a claim of omission and some particularized, substantive challenge to a license application", *Duke Energy Corp.* (Oconee Nuclear Station, Units 1, 2, and 3), CLI-99-11, 49 NRC 328, 333-35 (1999), and so the ASLB is constrained to find that summary disposition may not be granted here. While, as FENOC suggests, the Board may look to the "language of the bases" to ascertain a contention's scope, *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), LBP-01-23, 54 NRC 163, 171, that is the secondary approach. Examination of the language of the bases may occur only if the *primary* investigation, where the ASLB "look[s] first to the language of the contention," is "unavailing." *Id.* The Board framed the wording of Contention 1, and surely understands what its plain language means: that the contention is one of analysis, not of omission.

III. ISSUES OF FACT PROHIBIT SUMMARY DISPOSITION

Contention 1 has not been rendered moot by the Applicant's amendments to the Environmental Report. Contention 1 remains viable because the ER amendments have not addressed certain salient aspects of the contention. Accordingly, the contention should advance as admitted.

In *Matter of Georgia Institute of Technology* (Georgia Tech Research Reactor), 42 N.R.C. 191, 194 (1995), the legal standard for determining mootness of contentions was considered. "Mootness, in our view, is not necessarily dependent upon a party's view that its claims have been satisfied but, rather, occurs when a justiciable controversy no longer exists. See, generally, *Texas Utilities Electric Co.* (Comanche Peak Steam Electric Station, Unit 2), 37 NRC 192 (1993)." The contention that FENOC has not sufficiently analyzed alternative energy sources and combinations for baseload remains justiciable, because the utility has failed to properly address the feasibility of combinations of renewable fuels with storage, supplemented by natural gas.

The defects in the Environmental Report include the following:

> At the ER §7.0.2, FENOC now requests a definition of the Region of Interest (ROI) as delimited to the State of Ohio. But Applicant admits that "the electricity that Davis-Besse generates is sold on the wholesale power market." Applicant then claims that "there is no 'relevant service area' for the Plant." But the wholesale market is certainly larger than the State of Ohio and most likely, even larger than the full FirstEnergy service area. Petitioners insist that the ROI, at a minimum, must include the full service area of First Energy. Given developments such as that FirstEnergy has signed a power purchase agreement to buy the electricity generated by a 100,000-panel, 250-acre solar farm under development in Maryland at a state prison near Hagerstown[3], it is rather fatuous for the utility to claim that the ROI is limited to Ohio.

> In the original Contentions 1, 2, and 3, Petitioners included energy storage as an important component of wind or solar generation and included CAES as a convenient and appropriate example only. Petitioners did not thereby limit consideration of CAES

[3]http://www.energyboom.com/solar/firstenergy-signs-20-year-agreement-buy-energy-maryland-solar-farm

as the only storage technology. In fact, Petitioners specifically mentioned pumped hydro and other storage technologies. FENOC has not addressed any of these other storage technologies in its amended ER.

> In its analysis of the power generation from CAES, FENOC substantially exaggerates the emissions. FENOC imputes higher emissions from the CAES natural gas generators than from standard natural gas-fired generators (Combined Cycle Gas Turbine, or CCGT) by assuming 10 times higher sulfur content and higher particulate content for the CAES generation. Compare Tables 7.2-2 and 7.2-3.

> FENOC uses reasonable capacity factors for Wind and Solar to compute the total amount of wind or solar generation needed to replace Davis-Besse, when storage is included to give continuous generation. But then FENOC multiplies by a factor of two, imputing this to a Day/Night factor, when the capacity factor already includes the effect of nighttime, cloud cover, etc. Thus, various impacts including the land use impact is overestimated by at least a factor of two.

> In its amended analysis of Solar plus CAES, FENOC has ignored Petitioners' discussion of the adequacy of rooftops to satisfy the Solar requirements. FENOC claims incorrectly that rooftop solar is used primarily for what is known as "behind the meter" power. In fact, large quantities of rooftop solar have been and are continuing to be installed on large commercial buildings, especially warehouses which use very little power. Instead, the electricity is delivered to the grid and thence to other utility customers. This greatly reduces any substantial need for land area especially any land that is agriculturally productive or set aside for common park land, etc. Ecological impacts of Solar plus CAES will be small. FENOC has made a substantial error in this analysis.

> FENOC claims moderate socioeconomic impacts from a reduction in work force at D-B in the event that a license extension is not granted. This ignores the substantial workforce that would be required for decommissioning D-B, and for high-level radioactive waste management, that would extend over many decades. But more importantly, construction, operation and maintenance of either Wind or Solar or a combination of the two will contribute many more jobs than are presently at D-B, or even those involved in the nuclear fuel chain.

> FENOC claims significant, negative tax impacts from closing a nuclear Davis Besse. Ohio recently made adjustments in taxation to avoid substantially disadvantaging renewables such as wind and solar, but then established alternative payments *in lieu* of the standard public utility tangible personal property taxes. This legislation, re-ferred to as Ohio Senate Bill 232, established alternative payments to the county where the generation facilities are located. This would remove much of any purported burden on the surrounding community contingent on closing Davis-Besse.

> FENOC claims that photovoltaic electricity may require substantial water use associated with cleaning dust and dirt from PV modules' surfaces. This is not at all an issue in the service territory of FirstEnergy because of the presence of frequent precipitation. Existing data show that cleaning is unnecessary.

> Hazardous waste is also not an impact due to the physical structure of the PV systems and the robust recycling programs in place by PV manufacturers.

> When comparisons are drawn between emissions from the nuclear fuel chain and the proposed Wind and Solar alternatives with storage, detailed and careful consideration shows substantially higher emissions from Nuclear. These are emissions which are related especially to the very energy-intensive process of isotope separation which is reviewed in the accompanying Second Declaration of Alvin Compaan. When historically-accurate capacity factors are included in the analysis of the extended Nuclear option, the emissions impact puts the Nuclear option at a substantial disadvantage with respect to either the Wind or Solar plus storage. Since the present application is for a 20-year license extension, the appropriate historical capacity factor should average over the past 20 years. This is especially true since Davis-Besse will have aging reactor components and will be extending operation far beyond the design life of the reactor. Thus, a careful and realistic analysis should assume a D-B capacity factor that is no better than historical which is less than 80%. That being the case, FENOC will need to plan for 20% of electricity generation from conventional sources on an annual average. Thus, Petitioners conservatively estimate an additional emission component that is equivalent to having 20% of the 910 MW generating capacity of Davis-Besse being produced by coal generation, which is the primary base load generation technology of FirstEnergy. Refueling outages and other reportable "events" with nuclear reactors always extend to many days, often weeks and months, and some outages even have extended beyond a year, such as the 2002-2004 hole-in-the-head fiasco. Storage will not cover such outages. On the other hand, either wind or solar, partly since the generation is from multiple smaller generators that are widely dispersed, is not subject to such long-term interruptions. Unlike Nuclear, Renewables are supplemented nicely by storage such as CAES, pumped hydro, etc. because they do not experience extended outages. The equivalent capacity factor of large numbers of wind turbines and/or large numbers of solar installations combined with CAES will be essentially 100% and there will be no need for conventional replacement power. When the electricity inputs used in the U.S. for gaseous diffusion isotope separation are added in, the greenhouse gas emissions in CO2 equivalence of continued operation of D-B is about twice that of solar plus CAES.

Similar analysis can be applied to the Wind alternative. Consideration of other emissions such as NOx and SO2 will likely show even greater disadvantages for continuing D-B operation.

> 15. A key study on which FENOC relies for the conclusion that wind-generated baseload is infeasible actually states pellucidly that it is a desirable baseload power source. At ER p. .2-6, FENOC states:

> Jacobs and Archer *[sic]* completed a study of interconnected wind farms with consisting of up to 19 wind farm sites, and concluded that maximum capacity factors of approximately 45% could theoretically be obtained (JACM 2007).[4]

In truth, Archer and Jacobson say this in the Abstract on the first page of their article:

> Because it is intermittent, though, wind is not used to supply baseload electric power today [2006]. Interconnecting wind farms through the transmission grid is a simple and effective way of reducing deliverable wind power swings caused by wind intermittency. As more farms are interconnected in an array, wind speed correlation among sites decreases and so does the probability that all sites experience the same wind regime at the same time. The array consequently behaves more and more similarly to a single farm with steady wind speed and thus steady deliverable wind power. . . . *It was found that an average of 33% and a maximum of 47% of yearly averaged wind power from interconnected farms can be used as* ***reliable, baseload electric power****. Equally significant, inter-connecting multiple wind farms to a common point and then connecting that point to a far-away city can allow the long-distance portion of transmission capacity to be reduced, for example, by 20% with only a 1.6% loss of energy.*

(Emphasis supplied).

> No attempt was made to update the information in the Jacobson and Archer paper, which was written in 2006 and published in 2007. The paper was written using wind generation curves from GE 1.5 MW turbines. There are now more up to date, commer-cially available wind turbines. The 3 MW Vestas model V112 (www.vestas.com) starts generating power at lower wind speeds than the GE 1.5 MW turbines. The V112 also generates much more power at the same wind speeds and can continue to generate power at much higher wind speeds than the GE 1.5. This is also true of other manufacturers. GE now has a 4MW turbine with generation perameters similar to the V112. Because new, larger turbines perform better, they can provide baseload power at even a higher percentage.

Additional discussion of these points appears in the "Intervenors' Statement of Material Facts" and the "Second Declaration of Alvin Compaan," Intervenors' expert witness, both of which accompany this filing.

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[4]FENOC also incorrectly cited the Jacobs***on*** (not "Jacobs") and Archer article, "Supplying Baseload Power and Reducing Transmission Requirements by Interconnecting Wind Farms", which appears in the November 2007 Journal of Applied Meteorology and Climatology, Vol. 46, p. 1701 (article appears in "JAMC 2007", not "JACM 2007").

The above analyses reveal major failings by FENOC in trying to bring adequacy to the ER. FENOC still has not met its responsibility to "adequately evaluate the full potential for renewable energy sources, specifically wind power in the form of interconnected wind farms and/or solar photovoltaic power, in combination with compressed air energy storage, to offset the loss of energy production from Davis-Besse, and to make the requested license renewal action unnecessary" - the requirement of Contention 1.

IV. RESOLUTION OF FENOC'S MOTION WILL NOT EXPEDITE THE PROCEEDING

FENOC disclosed in its motion (p. 4) that "[t]he NRC Staff has shifted the date for issuing the Draft Supplemental Environmental Impact Statement ('DSEIS') for the Davis-Besse license renewal from October 2011, to January 2012, to consider, among other things, the 'in-depth alternatives' presented in FENOC's revised ER." FENOC launched its "Motion to Dismiss" on December 19, 2011, a date it freely chose, since its Motion could have been filed considerably earlier. It is presently January 2012; by the time the ASLB determines the merits of FENOC's "Motion to Dismiss", the Staff will have issued the DSEIS, which may undermine FENOC's claims of mootness on the question of alternatives.

According to 10 C.F.R. § 2.710(d)(1), the ASLB's "presiding officer need not consider a motion for summary disposition unless its resolution will serve to expedite the proceeding if the motion is granted." Even if the ASLB were to indulge the notion that Contention 1 is moot, FENOC's revised discussion of renewable energy alternatives in the ER might be not be viewed as especially complete by the NRC Staff. The ASLB and parties will know the answer to that question quite soon, and precisely because of the pendency of the DEIS for Davis-Besse, FENOC's attempt at summary disposition is particularly ill-timed. Consequently, FENOC's

motion should be summarily ignored.

WHEREFORE, for all the above reasons, Intervenors pray the Licensing Board deny the "Motion to Dismiss" and allow Contention 1 to advance to contested adjudication.

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STATEMENT OF MATERIAL FACTS IN OPPOSITION TO SUMMARY DISPOSITION

Now come Beyond Nuclear, Citizens Environment Alliance of Southwestern Ontario (CEA), Don't Waste Michigan, and the Green Party of Ohio (collectively, Intervenors), by and through counsel, and set forth their statement of material facts in opposition to summary disposition of Contention 1.

1. FENOC claims to have remedied an alleged omission through responses to a Staff request for additional information (RAI).

2. FENOC omitted to attach to its "Motion to Dismiss" a "separate, short, and concise statement of the material facts as to which the moving party contends that there is no genuine issue to be heard." See 10 C.F.R. §2.710(a).

3. Contention 1 says:

> The FirstEnergy Nuclear Operating Company's Environmental Report fails to adequately evaluate the full potential for renewable energy sources, specifically wind power in the form of interconnected wind farms and/or solar photovoltaic power, in combination with compressed air energy storage, to offset the loss of energy production from Davis-Besse, and to make the requested license renewal action unnecessary. The FENOC Environmental Report (§ 7.2) treats all of the alternatives to license renewal except for natural gas and coal plants as unreasonable and does not provide a substantial analysis of the potential for significant alternatives in the Region of Interest.

4. When it admitted contentions in this license extension case, the ASLB found:

> Although many of the Joint Petitioners' exhibits do not specifically address FirstEnergy's region of interest, we find that they have provided the required 'alleged facts' and 'minimal' factual support for admitting a challenge which questions the sufficiency of the ER's examination of wind power, solar photovoltaic power, and a combination of both as alternatives to relicensing Davis-Besse.

Davis-Besse, LBP-11-13 at 30 (slip op.). Moreover:

> [I] t appears to this Board that Joint Petitioners' contention posits that FirstEnergy should have identified a combination of wind and solar power as a reasonable alternative and analyzed it as such. Accordingly, we do not agree that Contention Three should be viewed as a contention of omission.

Id. at 32.

5. At revised §7.0.2 of the Davis-Besse Environmental Report, FENOC now requests a definition of the Region of Interest (ROI) as delimited to the State of Ohio. But Applicant admits that "the electricity that Davis-Besse generates is sold on the wholesale power market." Applicant then claims that "there is no 'relevant service area' for the Plant." But the wholesale market is certainly larger than the State of Ohio and most likely, even larger than the full FirstEnergy service area. FirstEnergy has signed a power purchase agreement to buy the electricity generated by a 100,000-panel, 250-acre solar farm under development in Maryland at a state prison near Hagerstown[1] and seems to have little basis to limit its Region of Interest to Ohio.

6. In the original Contentions 1, 2, and 3, Intervenors included energy storage as an important component of wind or solar generation and included CAES as a convenient and appropriate example only. Petitioners did not thereby limit consideration of CAES as the only storage technology, but in fact, specifically mentioned pumped hydro and other storage technologies. FENOC has not addressed any of these other storage technologies in its amended ER.

7. In its analysis of the power generation from CAES, FENOC substantially exaggerates the emissions. FENOC imputes higher emissions from the CAES natural gas generators than from standard natural gas-fired generators (Combined Cycle Gas Turbine, or CCGT) by assuming 10 times higher sulfur content and higher particulate content for the CAES generation. Compare Tables 7.2-2 and 7.2-3.

8. FENOC uses reasonable capacity factors for Wind and Solar to compute the total amount of wind or solar generation needed to replace Davis-Besse, when storage is included to

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give continuous generation. But then FENOC multiplies by a factor of two, imputing this to a Day/Night factor, when the capacity factor already includes the effect of nighttime, cloud cover, etc. Thus, various impacts including the land use impact is overestimated by at least a factor of two.

9. In its amended analysis of Solar plus CAES, FENOC has ignored Petitioners' discussion of the adequacy of rooftops to satisfy the Solar requirements. FENOC claims incorrectly that rooftop solar is used primarily for what is known as "behind the meter" power. In fact, large quantities of rooftop solar have been and are continuing to be installed on large commercial buildings, especially warehouses which use very little power. Instead, the electricity is delivered to the grid and thence to other utility customers. This greatly reduces any substantial need for land area especially any land that is agriculturally productive or set aside for common park land, etc. Ecological impacts of Solar plus CAES will be small. FENOC has made a substantial error in this analysis.

10. FENOC claims moderate socioeconomic impacts from a reduction in work force at D-B in the event that a license extension is not granted. This ignores the substantial workforce that would be required for decommissioning D-B, and for high-level radioactive waste management that would extend over many years. But more importantly, construction, operation and maintenance of either Wind or Solar or a combination of the two will contribute many more jobs than are presently at D-B, or even those involved in the nuclear fuel chain.

11. FENOC claims significant, negative tax impacts from closing a nuclear Davis Besse. Ohio recently made adjustments in taxation to avoid substantially disadvantaging renewables such as wind and solar, but then established alternative payments *in lieu* of the standard public utility tangible personal property taxes. This legislation, referred to as Ohio Senate Bill 232, established alternative payments to the county where the generation facilities are located. This would remove much of any purported burden on the surrounding community contingent on closing D-B.

12. FENOC claims that photovoltaic electricity may require substantial water use associated with cleaning dust and dirt from PV modules surfaces. This is not at all an issue in the service territory of FirstEnergy because of the presence of frequent precipitation. Existing data show that cleaning is unnecessary.

13. Hazardous waste is also not an impact due to the physical structure of the PV systems and the robust recycling programs in place by PV manufacturers.

14. When comparisons are drawn between emissions from the nuclear fuel chain and the proposed Wind and Solar alternatives with storage, detailed and careful consideration shows substantially higher emissions from Nuclear. These are emissions which are related especially to the very energy-intensive process of isotope separation which is reviewed in the accompanying Second Declaration of Alvin Compaan. When historically-accurate capacity factors are included in the analysis of the extended Nuclear option, the emissions impact puts the Nuclear option at a

substantial disadvantage with respect to either the Wind or Solar plus storage. Since the present application is for a 20-year license extension, the appropriate historical capacity factor should average over the past 20 years. This is especially true since Davis-Besse will have aging reactor components and will be extending operation far beyond the design life of the reactor. Thus, a careful and realistic analysis should assume a D-B capacity factor that is no better than historical which is less than 80%. That being the case, FENOC will need to plan for 20% of electricity generation from conventional sources on an annual average. Thus, Petitioners conservatively estimate an additional emission component that is equivalent to having 20% of the 910 MW generating capacity of Davis-Besse being produced by coal generation, which is the primary base load generation technology of FirstEnergy. Refueling outages and other reportable "events" with nuclear reactors always extend to many days, often weeks and months, and some outages even have extended beyond a year. Storage will not cover such outages. On the other hand, either wind or solar, partly since the generation is from multiple smaller generators that are widely dispersed, is not subject to such long-term interruptions. Unlike Nuclear, Renewables are supplemented nicely by storage such as CAES, pumped hydro, etc. because they do not experience extended outages. The equivalent capacity factor of large numbers of wind turbines and/or large numbers of solar installations combined with CAES will be essentially 100% and there will be no need for conventional replacement power. When the electricity inputs used in the U.S. for gaseous diffusion isotope separation are added in, the greenhouse gas emissions in CO2 equivalence of continued operation of D-B is about twice that of solar plus CAES.

Similar analysis can be applied to the Wind alternative. Consideration of other emissions such as NOx and SO2 will likely show even greater disadvantages for continuing D-B operation.

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> Jacobs and Archer *[sic]* completed a study of interconnected wind farms with consisting of up to 19 wind farm sites, and concluded that maximum capacity factors of approximately 45% could theoretically be obtained (JACM 2007).[2]

Archer and Jacobson say this in the Abstract on the first page of their article:

> Because it is intermittent, though, wind is not used to supply baseload electric power today [2006]. Interconnecting wind farms through the transmission grid is a simple and effective way of reducing deliverable wind power swings caused by wind intermittency. As more farms are interconnected in an array, wind speed correlation among sites decreases and so does the probability that all sites experience the same wind

[2]FENOC also has incorrectly cited the Jacobs***on*** (not "Jacobs") and Archer article, "Supplying Baseload Power and Reducing Transmission Requirements by Interconnecting Wind Farms", which appears in the November 2007 Journal of Applied Meteorology and Climatology, Vol. 46, p. 1701 (appears in "JAMC," not in "JACM").

> regime at the same time. The array consequently behaves more and more similarly to a single farm with steady wind speed and thus steady deliverable wind power. . . . *It was found that an average of 33% and a maximum of 47% of yearly averaged wind power from interconnected farms can be used as* ***reliable, baseload electric power****. Equally significant, interconnecting multiple wind farms to a common point and then connecting that point to a far-away city can allow the long-distance portion of transmission capacity to be reduced, for example, by 20% with only a 1.6% loss of energy.*

(Emphasis supplied).

16. The Jacobson and Archer paper which was written in 2006 and published in 2007 and there was no attempt to update the ER analysis to contemporary or anticipated utility-scale wind generation technology. The paper was written using wind generation curves from GE 1.5 MW turbines. There are now more up to date, commercially available wind turbines. The 3 MW Vestas model V112 starts generating power at lower wind speeds than the GE 1.5 MW turbines. Www.vestas.com. The V112 also generates much more power at the same wind speeds and can continue to generate power at much higher wind speeds than the GE 1.5. This is also true of other manufacturers. GE now has a 4MW turbine with generation perameters similar to the V112. Because new, larger turbines perform better, they can provide baseload power at even a higher percentage.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
		Docket No. 50-346-LR
First Energy Nuclear Operating Company	)	
(Davis-Besse Nuclear Power Station, Unit 1)		January 9, 2011
.	)	
	;	

* * * * *

SECOND DECLARATION OF ALVIN COMPAAN, PH. D., INTERVENORS' EXPERT WITNESS

Now comes Alvin Compaan, Ph.D., Declarant herein, who declares as follows under penalty of perjury:

1. I am a professor of physics at the University of Toledo, located in Toledo, Ohio, and hold a Ph.D. degree in physics from the University of Chicago. My current *curriculum vitae* is attached hereto and made a part of this declaration.

2. I have read and reviewed in its entirety the Environmental Report revisions provided the NRC by FENOC and identified as ""License Renewal Application Amendment 16 for the Review of the Davis-Besse Nuclear Power Station, Unit No. 1, License Renewal Application Environmental Report", *available at* ADAMS Accession No. ML11266A062.

3. Attached to this Declaration are eight (8) pages, which comprise my critique of the Environmental Report, as revised, the contents of which I incorporate by reference into this Declaration. I offer my conclusions in support of the Intervenors' opposition to dismissal and/or summary disposition of Contention 1 in this proceeding. I have stated the conclusions which appear therein based upon my knowledge and experience and to a degree of scientific certainty.

4. Further Declarant saith naught.

Jan 7, 2012
Date

Alvin Compaan, Ph.D.

The following discussion addresses the FENOC Motion (dated Dec. 19, 2011) to Dismiss Contention 1 of the Petitioners in view of FENOC's License Renewal Application Amendment No. 16 dated Sept. 19, 2011, FENOC's revised Environmental Report.

The comments below are from A.D. Compaan, 1/1/12

FENOC in it's amended ER, has provided an improvement to their earlier Environmental Report (ER) discussing alternative sources of generating capacity that would make unnecessary for a 20 year license renewal of Davis-Besse (D-B) Nuclear Power Plant. However, this amended ER contains many substantial errors, omissions, and distortions. The Petitioners challenge this motion on the basis of the validity of key elements of the information presented and on other relevant information that has been omitted.

Therefore, we contend that the ASLB must deny this motion to dismiss the Joint Petitioners' (JP) Contention 1 as restated by the ASLB. In the material below we challenge, first, the proposed definition of the region of interest (ROI) and then address many of the errors in a point-by-point refutation.

7.0.2 ROI--FENOC at 7.0.2 now requests a definition of the Region of Interest (ROI) as delimited to the State of Ohio. However, Applicant admits that "the electricity that Davis-Besse generates is sold on the wholesale power market." Applicant then claims "that there is no 'relevant service area' for the Plant." This conclusion defies logic. The wholesale market is certainly larger than the State of Ohio and most likely even larger than the full First Energy service area. Consequently, Petitioners insist that the ROI, at a minimum, must include the full service area of First Energy.

Summary of Petitioner's substantive technical objections to FENOC's Amended ER and Motion to Dismiss:

1. In the original Contentions 1, 2, and 3, Petitioners included energy storage as an important component of wind or solar generation and included CAES *as a convenient and appropriate example only*. Petitioners did not thereby limit consideration of CAES as the only storage technology. In fact, Petitioners specifically mentioned pumped hydro and other storage technologies. FENOC has not addressed any of these other storage technologies in its amended ER.
2. In its analysis of the power generation from CAES, FENOC substantially exaggerates the emissions. FENOC imputes higher emissions from the CAES natural gas generators than from standard natural gas-fired generators.(CCGT) by assuming 10 times higher sulfur content and higher particulate content for the CAES generation. Compare Tables 7.2-2 and 7.2-3.
3. FENOC uses reasonable capacity factors for Wind and Solar to compute the total amount of wind or solar generation needed to replace Davis-Besse, when storage is included to give continuous generation. But then FENOC multiplies by a factor of two imputing this to a Day/Night factor, when the capacity factor already includes the effect of nighttime,

cloud cover, etc. Thus, various impacts including the land use impact is overestimated by at least a factor of two. We explain the error in detail.

Furthermore, in its amended analysis of Solar plus CAES, FENOC has ignored Petitioners' discussion of the adequacy of rooftops to satisfy the Solar requirements. FENOC claims incorrectly that rooftop solar is used primarily for what is known as "behind the meter" power. In fact, large quantities of rooftop solar have been and are continuing to be installed on large commercial buildings, especially warehouses which use very little power. Instead, the electricity is delivered to the grid and thence to other utility customers. This greatly reduces any substantial need for land area especially any land that is agriculturally productive or set aside for common park land, etc. Ecological impacts of Solar plus CAES will be SMALL. FENOC has made a substantial error in this analysis.

4. FENOC claims MODERATE Socioeconomic impacts from a reduction in work force at D-B in the event that a license extension is not granted. First, this ignores the substantial workforce that would be required for decommissioning D-B that would extend over many years. But more importantly, construction, operation and maintenance of either Wind or Solar or a combination of the two will contribute many more jobs than are presently employed at D-B or are involved in the nuclear fuel chain.
5. FENOC claims significant, negative tax impacts from closing a nuclear Davis Besse. Ohio recently made adjustments in the taxation to avoid substantially disadvantaging renewables such as wind and solar, but then established alternative payments in lieu of the standard public utility tangible personal property taxes. This legislation is usually referred to as Ohio Senate Bill 232 which established alternative payments to the county where the generation facilities are located. This would remove much of any purported burden on the surrounding community contingent on closing D-B.
6. FENOC claims that PV may require substantial water use associated with cleaning dust and dirt from PV modules surfaces. This is not at all an issue in the service territory of First Energy because of frequent precipitation. There is existing data showing that cleaning is unnecessary.
7. Hazardous waste is also not an impact due to the physical structure of the PV systems and the robust recycling programs in place by PV manufacturers.
8. When comparisons are drawn between emissions from the nuclear fuel cycle and the proposed Wind and Solar alternatives with storage, detailed and careful consideration shows substantially higher emissions from Nuclear. These are emissions related especially to the very energy-intensive process of isotope separation which is reviewed here. When historically accurate capacity factors are included in the analysis of the extended Nuclear option, the emissions impact puts the Nuclear option at a substantial disadvantage with respect to either the Wind or Solar plus storage. Since the present application is for a 20-year license extension, the appropriate historical capacity factor should average over the past 20 years. This is especially true since Davis-Besse will have aging reactor components and will be extending operation far beyond the design life of the reactor. Thus, a careful and realistic analysis should assume a D-B capacity factor that is no better than historical which is less than 80%. That being the case, FENOC will need to plan for 20% of electricity generation from conventional sources on an annual average. Thus, Petitioners conservatively estimate an additional emission component that is equivalent to having 20% of the 910 MW generating capacity of Davis-Besse being

produced by coal generation, which is the primary base load generation technology of First Energy. We note that refueling outages and other reportable "events" with nuclear reactors always extend to many days, often weeks and months, and some outages even have extended beyond a year. Storage will not cover such outages. On the other hand, either wind or solar, partly since the generation is from multiple smaller generators that are widely dispersed, is not subject to such long-term interruptions. Unlike Nuclear, Renewables are supplemented nicely by storage such as CAES, pumped hydro, etc. because they do not experience extended outages. The equivalent capacity factor of large numbers of wind turbines and/or large numbers of solar installations combined with CAES will be essentially 100% and there will be no need for conventional replacement power. We find, when the electricity inputs used in the U.S. for gaseous diffusion isotope separation, that the greenhouse gas emissions in CO_2 equivalence of continued operation of D-B is about twice that of solar plus CAES. Similar analysis can be applied to the Wind alternative. Consideration of other emissions such as NO_x and SO_2 will likely show even greater disadvantages for continuing D-B operation. These are compelling arguments for denying the FENOC motion to dismiss.

Detailed discussion with references to the FENOC Amended ER and to supporting documentation follows:

1) **Storage technology not limited to CAES**--In the original Contentions 1, 2, and 3 (restructured as Contention 1 by the ASLB), Joint Petitioners included energy storage as an important component of wind or solar generation and included CAES *as a convenient and appropriate example only*. Petitioners did *not* thereby limit themselves to the consideration of CAES as the *only* storage technology. In fact, Petitioners specifically mentioned pumped hydro and other storage technologies. FENOC has not addressed any of these other storage technologies in its amended ER.

2) **Emissions from CAES gas turbines** (p. 7.2-22, Table 7.2-3): This analysis of gas turbine emission associated with CAES is substantially distorted by some incorrect assumptions. FENOC appears to have used a calculation of emissions from CAES power generation that is taken from an environmental permit granted by the Ohio EPA which sets upper limits rather than a calculation that assumes use of the best available technology. Petitioners hereby claim that the comparative emissions from CAES generation should be done with the same assumptions as for stand-alone gas-fired generation (Table 7.2-2). This was done for a Combined Cycle Gas Turbine (CCGT) which employs a steam turbine to generate power from the waste heat of the gas turbine. Most analyses indicate that the use of CAES in the compression stage yields an efficiency that is at least twice the conventional, or in any case yielding a heat rate of less than 4,000 BTU/kWh.[1, 2, 3] Thus, a factor of two lower than the CCGT example discussed in Table 7.2-2 would yield a heat rate of 3,250 BTU/kwh. FENOC has substantially underestimated the efficiency when the turbine system is supercharged by the CAES, and this conveniently makes

[1] http://www.apexcaes.com/caes.php
[2] http://disgen.epri.com/downloads/EPRI CAES Demo Proj.Exec Overview.Deep Dive Slides.by R. Schainker.Auguat 2010.pdf
[3] http://www.espcinc.com/mobile/index.php?option=com_k2&view=item&id=6:caes-advance-second-generation-with-inlet-chilling&Itemid=3

the alternative generation scenarios less attractive to FENOC. The calculations must be honestly done.

A more egregious distortion arises from the assumptions made in the sulfur content of the natural gas fuel. For the CAES turbine generation, the fuel is assumed to have 2 grains/100 scf or 0.0066wt%; however, the "gas-fired alternative" or CCGT is being fed natural gas with a sulfur content of only 0.2 grains/100 scf or 0.00068 wt%. Thus Petitioners argue that the SO_2 emissions, due to this assumption, is overestimated by a factor of 10.

For unexplained reasons particulate emissions are similarly claimed to be higher for the CAES generation by a factor of 3.5. CO_2 emissions per MMBTU are claimed to be equivalent, which ignores the higher efficiency of the CAES generation system. Numbers for CO and NO_x emission are not presented in comparable units or in numbers that can be related readily to the emissions per kWh. This must be corrected.

Finally, the 804 MW CAES capacity will not be used during the periods when Solar and/or Wind generation is active. Thus the emissions should be reduced by the factor of (1-capacity factor of solar or wind). For Solar, this is (1-0.24) = 0.76. For interconnected Wind, this is (1-0.45) = 0.55. These factors yield substantial additional reductions in calculated emissions.

3) **Wind and PV power and the land-use estimate with storage**

a) FENOC makes a fundamental error in its calculation of land area needed both for interconnected wind and for PV. This is illustrated by the following excerpt from p.7.3-14 (Section 7.3.3.1):

> Assuming the use of interconnected wind as the only renewable source to generate the equivalent of Davis-Besse's net output of 910 MWe base-load power plus 910 MWe of energy storage to be used when wind power is not available, a series of wind farms with 2.0-MWe turbines with an average capacity factor of 30% as specified by PJM and USDOE (**PJM 2011** and **USDOE 2011**) would require approximately 3030 turbines to produce 1820 MWe.

First, interconnected wind is likely to have a larger capacity factor, probably 45%, although this will depend on the geographical area used for the wind installation. However, for the sake of discussion here we will provisionally accept a capacity factor of 30% for wind. Generating the same amount of energy as a continuous power source at 910 MW will then require peak generation capacity of 3033 MW. Since the demand is predicated on 910 MW, this means that at peak wind power, 2123 MW is available for charging the CAES. It is incorrect to claim that there will need to be an *additional* 910 MW of average generation capacity. When FENOC specifies 3030 turbines of 2 MW power, they are requiring a peak generation capacity of 6060 MW. This is patently false! Thus, e.g., the land area calculation is excessive by at least a factor of two.

The same mistake is made for Solar (p. 7.3-23; Section 7.3.3.3). FENOC uses a 24% capacity factor for solar, which is reasonable, and then claims "…plus an additional 910 MWe needed for energy storage…" This is double counting. Including the capacity factor of 0.24 means that the installed solar will be 4.17 times 910 MW or 3,790 MW. It is this excess capacity that will produce the energy to be stored in the CAES. It is erroneous to claim that another 910 MW is needed. Consequently, the correct area calculation for PV is about 19,000 acres. (Actually, since PV efficiencies and installation packing densities have increased since the 2002 NREL study, the lower number of 3.8 acres per MW is more

reasonable and is even on the high side. Thus Petitioners would argue that a better current estimate of total needed area should be 14,500 acres or 22.6 sq. miles or a square 4.76 miles on a side.

b) FENOC then proceeds to dismiss rooftops for the siting of PV. (p. 7.3-24). In doing so, they have completely ignored the discussion Petitioners earlier presented in our response to FE's answer and the NRC staff's answer to JP's request for Hearing. The suitability of rooftop space was explicitly addressed and FENOC has presented no contrary evidence other than the qualitative and unsupported statement that "*PV arrays are placed on the rooftops of businesses and residential dwellings to generate electricity or to heat water. These units are usually small and are designed to provide energy directly to the facility or residence to which they are attached. Only in a few cases are these PV arrays large enough to provide excess energy to the grid.*" In fact, in the last several years, warehouse rooftop installations of PV have become very popular in the U.S. and in many European countries. Petitioners can provide additional supporting evidence but believe that the information provided earlier is clearly sufficient to debunk this specious claim. It is summarized below.

Maya Chaudhari, Lisa Frantzis, and Dr. Tom E. Hoff in an article entitled "PV Grid Connected Market Potential in 2010 Under a Cost Breakthrough Scenario," September 2004 have provided this analysis:[4]

> "The state-by-state analysis, the first of its kind, concludes that the potential U.S. market for grid-connected solar rooftop PV could reach 2,900 MW per year by 2010, assuming that the solar industry can achieve a "breakthrough" price of $2.00-$2.50 per installed watt….Rooftop space is not a constraining factor for solar development. Residential and commercial rooftop space in the U.S. could accommodate up to 710,000 MW of solar electric power (if all rooftops were fully utilized, taking into account proper orientation of buildings, shading from trees, HVAC equipment, and other solar access factors). For comparison, total electricity-generating capacity in the U.S. today is about 950,000 MW."

Note that this analysis projects the natural development of a solar market that depends on price, and is not the maximum possible growth that could be achieved with strong incentives or a decision by First Energy to proceed with a solar alternative. In the past year (2011) the module price has dipped to about $1.00-$1.20 per watt. The installed price is typically about a factor of two higher so we are now clearly within the range anticipated by this study done 7 years ago.

The land area impacts of PV that are discussed by FENOC are intended to be land area not available to be used for other purposes. When PV is placed on rooftops it certainly does not prevent normal usage.

Petitioners are willing further, for the sake of illustrating the potential for solar power, to restrict the consideration of rooftop space only to commercial rooftops that are suitable for PV. For this we rely on the recent study by Paul Denholm and Robert Margolis of NREL, "Supply Curves for Rooftop Solar PV-Generated Electricity for the United States," 2008.[5]

Petitioners use the data of Denholm and Margolis, including these constraints of shading and orientation, etc, for the flat commercial rooftops in the Cleveland-Akron-Youngstown-

[4] http://www.ef.org/documents/EF-Final-Final2.pdf
[5] http://www.nrel.gov/docs/fy09osti/44073.pdf

Toledo metro areas—all FE territory—to obtain the solar generation potential. The commercial roof space can reasonably be estimated to yield 4,400 MW of solar electricity at peak.

This demonstrates that the generating capacity of solar, together with the storage capacity of Norton, can readily provide a very viable alternative to Davis-Besse, without impacting any additional land area. Of course we do not presume that the PV will only be installed on commercial flat roofs but on residential rooftops as well and many other locations not valuable for agriculture, recreation, or industrial and business uses. These could include retired landfills, railroad and highway right-of-ways, etc.

Thus the land impacts of Solar as a replacement for Davis-Besse are very small to nonexistent.

4) **Socioeconomic impact**-jobs—(pp. 7.3-26, 7.3-29) On the issue of job/employment intensity, there has been a vigorous debate about the relative labor intensity of various forms of electricity production—coal, nuclear, natural gas, wind, solar, etc. However, a major component of the labor intensity of the capital-intensive electricity generation technologies including Nuclear, Wind, and Solar, is the workforce involved in the initial construction of the facilities. Since D-B is already built, it is highly unlikely that a careful analysis will show higher labor intensity (jobs per MWh) for D-B than for Wind and Solar for which most of the installation is yet to be done. However, most analysts also find that the operation and maintenance workforce for Wind and Solar will be substantially higher than for Nuclear.[6] [7] Petitioners maintain that the alternatives proposed in the restated Contention 1 will provide a substantial workforce employment advantage over Nuclear particularly in the FE ROI.[8] [9] (Recall that the nuclear fuel stream including mining, refining, and isotope separation, generates much of the employment well outside the FE ROI and indeed outside the U.S.

5) **tax revenue** (p. 7.3-17)—Ohio recently made some adjustments in the taxation to avoid substantial disadvantages to renewables such as wind and solar with taxation based on peak power generation capacity. However, alternative payments are mandated in lieu of the standard public utility tangible personal property tax. However, as of January 2011, Ohio Senate Bill 232 established alternative payments to the county where the generation facility is located.[10]

These payments are based on the size and type of facility as well as the annual energy production. Were D-B to be decommissioned, FE would have the option of building much of the renewable generation capacity in the counties that might be impacted by the loss of revenue from D-B. Petitioners maintain, therefore, that the tax impacts would be SMALL.

6) **Water use** (p. 7-3-19)—There would be a big advantage to the Wind + CAES over water use from D-B. In the FENOC territory, there is plenty of precipitation and no cleaning should be

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[6] Daniel Kammen, Kamal Kapadia, and Matthias Fripp, "Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Create?" UC Berkeley: Renewable and Appropriate Energy Laboratory (RAEL), April 2004 (updated January 2006), 12, http://rael.berkeley.edu/files/2004/Kammen-Renewable-Jobs-2004.pdf

[7] Virinder Singh, BBC Research and Consulting, and Jeffrey Fehrs, "The Work That Goes into Renewable Energy," Renewable Energy Policy Project, November 2001, 8.

[8] http://www.ucsusa.org/clean_energy/solutions/big_picture_solutions/a-bright-future-for-the-heartland.html

[9] http://www.windpowerengineering.com/policy/wind-power-more-efficient-than-you-thought/

[10] http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=OH60F&re=1&ee=1

needed. That is, there will be *no water usage at all* for PV Solar operation. Prof. Compaan has roof-mounted modules on his home in Toledo which have not been cleaned in 7 years and their operating efficiency is not noticeably changed.

7) **Hazardous Waste Management** (p. 7.3-26) **—**FENOC claims "The cumulative and long-range impacts from transporting and disposing of hazardous waste could be SMALL to MODERATE." The speculative word "could" is revealing here. In fact, one of the world's largest manufacturers of CdTe-based PV modules is First Solar and it manufactures much of its product in the First Energy territory (Perrysburg, OH). First Solar has implemented a robust recycling strategy which is funded through a banked escrow set-aside funded with a surcharge on each module sold. This fund will pay for the recycling of any damaged modules and all modules that reach end of life which is expected to be well beyond the 25 year warranty. This claim that the impact from waste *could* be moderate is totally unsupported and patently false. The environmental impact is SMALL.

8) **Emissions from Nuclear**—FENOC provides in the Amended ER a table of "Impacts Comparison Detail" (Table 8.0-2) in which all Nuclear impacts are classified as "small." It is difficult to challenge such a qualitative assessment, but there are data available on some of the emissions from the nuclear fuel cycle. Clearly, if a new D-B plant needed to be constructed the emissions would be very much higher. It is often assumed that the *operation* of a nuclear power plant is almost pollution free, except for the waste heat that is largely removed at D-B by vaporizing water taken from Lake Erie. However, there are several studies of the emissions from the nuclear fuel cycle and we use these to compare the emissions from operation of D-B with the alternative operation of Solar plus CAES which can be done with the help of data of Table 7.2-3 as corrected above. Under these assumptions, Solar plus CAES yields 162 kg / MWh, assuming the 3250 BTU/kWh of heat rate discussed in Section 2) above.

Uranium enrichment in the U.S. is primarily by gaseous diffusion which is very energy (electricity) intensive and most of that electricity is generated from coal.[11] Data from the World Nuclear Association give the greenhouse gas emission contribution (from enrichment only) as 40 kg of CO_2 equivalent per MWh of electricity generated from nuclear. The other 20% of generation, for the time that D-B is off-line, we assume to be replaced by coal generation which is the other preferred base-load technology for FE. For this generation, we can calculate the CO_2 emissions from the FE data of Table 7.2-1. These emissions from coal-generated electricity are 1091 kg/MWh. Thus, we can calculate the CO_2 emissions for 80% nuclear and 20% coal to average at

$$0.8\ (40\ \text{kg/MWh}) + 0.2\ (1091\ \text{kg/MWh}) = 250\ \text{kg}\ CO_2\ \text{equiv. / MWh.}$$

A similar calculation can be done for 24% Solar plus 76% CAES yields:

$$0.24\ (\ 0) + 0.76\ (162\ \text{kg/MWh}) = 123\ \text{kg}\ CO_2\ \text{equiv. / MWh}$$

These calculations show that the Solar-plus-CAES option would yield only about half of the CO_2 emissions per MWh as the continued operation of Davis-Besse. One can challenge the operating

[11] Energy Analysis of Power Systems: World Nuclear Association, updated Jan 2011 [http://world-nuclear.org/info/infl1.html]

efficiency of the CAES turbine and add some CO_2 equivalent emissions from the production of solar modules; however, these additions will be more than balanced by the CO_2 equivalent emissions from other parts of the nuclear fuel cycle including mining, milling, fuel rod fabrication, reprocessing, storage, and long-term disposal.[12] It is the Petitioners' contention that these adjustments will not substantially change the conclusion that greenhouse gas emissions from the continued operation of Davis-Besse will be about twice as much per MWh as the proposed alternative of Solar plus CAES storage. Consideration of other pollutants such as SO_2, NO_x, CO, Hg, and microscopic particulants would put the D-B option at an even stronger disadvantage environmentally.

Similar analysis will apply to the interconnected Wind option as well as the Wind plus CAES or other storage option. Thus, the renewable options, including storage, are clearly advantageous over the continued operation of D-B.

For all of the above reasons, this request for dismissal of Contention 1 must be rejected.

ADC Jan 1, 2012

[12] Lenzen, M. (2008) "Life cycle energy and greenhouse gas emissions of nuclear energy: A review." Energy Conversion and Management 49, 2178-2199

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
		Docket No. 50-346-LR
First Energy Nuclear Operating Company	)	
(Davis-Besse Nuclear Power Station, Unit 1)		January 9, 2011
.	)	
	;	

* * * * *

CERTIFICATE OF SERVICE

We hereby certify that a copy of the foregoing "Intervenors' Memorandum in Opposition to 'Motion to Dismiss'", "Intervenors' Statement of Material Facts," and "Second Declaration of Alvin Compaan" were sent by us to the following persons via electronic deposit filing with the Commission's EIE system this 9th day of January, 2012:

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